SYNTHESIS OF SOME NOVEL HETEROCYCLIC COMPOUNDS AND THEIR BIOLOGICAL EVALUATION

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SYNOPSIS OF THESIS

Heterocyclic chemistry constitutes an essential branch of organic chemistry. Heterocycles are widely known to display a range of bioactive properties which are widely utilized in the pharmaceutical and agricultural sectors. Heterocyclic compounds, especially nitrogen heterocycles, are the most important class of compounds in the pharmaceutical and agrochemical industries, with comprising around 60% of all drug substances. The nitrogen containing heterocycles form a diverse class of organic molecules that have received extensive significance owing to their presence in many natural products and synthetic drugs. Nitrogen containing heterocycles are important, not only because of their abundance, but above all because of their diversified biological and chemical properties. Nitrogen containing heterocycles form the integral part of many natural products, such as vitamins, hormones, antibiotics, alkaloids, as well as they have established a firm place in pharmaceutical industry.

Although numerous methods exist to construct a range of nitrogen containing heterocyclic systems, new strategies with reduced numbers of transformation steps, lower costs, environmentally safe with minimized chemical waste are still in high demand and are hot area of research in the industries. The solution to these challenges can be achieved by utilizing the multicomponent reactions (MCRs). The MCRs is a evident powerful tool for the rapid introduction of molecular diversity. The design and development of MCRs for the generation of heterocycles is receiving growing interest as they produce complex products in high yields with minimal efforts. The advantages of employing MCRs can be attributed to the creation of environmentally friendly process by reducing the number of synthetic steps, energy consumption and waste production. Therefore, the discovery for new MCRs and improving already known MCRs is of ample interest to the researchers.

Modern synthetic organic chemistry is in a period of rapid change because of the many demands it is facing today Although the existing MCRs for the construction of nitrogen containing heterocycles are effective, but still there is scope of improving the existing methods by employing an mild reaction conditions utilizing an environment friendly catalyst like papain. The need for more efficient MCRs in organic synthesis requires the development and use of inevitably more advanced catalytic methods. The pharmaceutical industries which have tremendous impact on our society are constantly under pressure; due to more restricted

environmental regulations to reduce the detrimental impact of their processes on the environment. In the past the main issue for the industries was process economics, nowadays they are preferring process that are environmentally friendly. This pressure on industry is giving an extra impetus to researchers to discover more environmentally friendly synthetic methods in different research areas by avoid the use of toxic and expensive catalysts.

In the proposed research work entitled **"Synthesis of some novel heterocyclic compounds and their biological evaluation"**, an efficient synthetic protocol for molecules belonging to class of trisubstituted imidazole, tetrasubstituted imidazole, benzimidazole, disubstituted benzimidazole, pyrimidine, quinoxaline, nicotine and pyridine were catalyzed by papain as a biocatalyst and were further evaluated for the antibacterial activity. Herein our main aim was to establish papain as a novel biocatalyst, that promoted synthesis of variety of organic transformation forming an array of bioactive nitrogen containing heterocycles as mentioned above. The papain as a biocatalyst was safe, economical and environmentally benign carrying out complex organic MCRs with outmost ease. In addition this research work may lead the foundation of exploration of such biocatalyst (like papain) on a larger scale.

The present work entitled **"Synthesis of some novel heterocyclic compounds and their biological evaluation"** is aimed at,

i. Establishment of papain as biocatalyst.
ii. To study the application of papain as a biocatalyst for various organic transformations.
iii. To develop efficient synthetic protocol for trisubstituted imidazole, tetrasubstituted imidazole, benzimidazole, disubstituted benzimidazole, pyrimidine, quinoxaline, nicotinamide and pyridine catalyzed by papain as a biocatalyst.
iv. Characterization and biological evaluation of trisubstituted imidazole, tetrasubstituted imidazole, benzimidazole, disubstituted benzimidazole, pyrimidine, quinoxaline, nicotinamide and pyridine for antibacterial activity.

The present work is described in six chapters

Chapter-I: General Introduction

This chapter deals with literature survey and general introduction about the papain and multicomponent reactions in which it is intended to be employed.

Chapter-II: Papain as biocatalyst

This chapter deals with the information about papain as an enzyme. It deals with variety of activities possessed by papain. It also highlights the other utilities of papain. This chapter deals with why and how papain was the selected choice to act as biocatalyst in organic transformation.

Chapter-III: Synthesis and biological evaluation of trisubstituted imidazole and tetrasubstituted imidazole catalyzed by papain.

This chapter describes the synthetic methods and the biological importance of the imidazole heterocycles according to the literature. In addition it describes a simple and efficient method for the synthesis and biological evaluation of trisubstituted imidazole and tetrasubstituted imidazole catalyzed by papain. This chapter is further divided into two sections as,

Section A: Simple and efficient synthesis of trisubstituted imidazole catalyzed by papain and their evaluation for antibacterial activity.

Section B: Simple and efficient synthesis of tetrasubstituted imidazole catalyzed by papain and their evaluation for antibacterial activity.

Chapter-IV: Synthesis and biological evaluation of benzimidazole and disubstituted benzimidazole catalyzed by papain.

This chapter describes the synthetic methods and the biological importance of the benzimidazole heterocycles according to the literature. In addition it describes a simple and efficient method for the synthesis and biological evaluation of benzimidazole and disubstituted benzimidazole catalyzed by papain. This chapter is further divided into two sections as,

Section A: Simple and efficient synthesis of benzimidazole catalyzed by papain and their evaluation for antibacterial activity.

Section B: Simple and efficient synthesis of disubstituted benzimidazole catalyzed by papain and their evaluation for antibacterial activity.

Chapter-V: Synthesis and biological evaluation of pyridine and pyrimidine catalyzed by papain.

This chapter describes the synthetic methods and the biological importance of the pyridine and pyrimidine heterocycles according to the literature. In addition it describes a simple and efficient method for the synthesis and biological evaluation of pyridine and pyrimidine catalyzed by papain. This chapter is further divided into two sections as,

Section A: Simple and efficient synthesis of pyridine catalyzed by papain and their evaluation for antibacterial activity.

Section B: Simple and efficient synthesis of pyrimidine catalyzed by papain and their evaluation for antibacterial activity.

Chapter-VI: Synthesis and biological evaluation of quinoxaline and nicotinamide catalyzed by papain.

This chapter describes the synthetic methods and the biological importance of the quinoxaline and nicotinamide heterocycles according to the literature. In addition it describes a simple and efficient method for the synthesis and biological evaluation of quinoxaline and nicotinamide catalyzed by papain. This chapter is further divided into two sections as,

Section A: Simple and efficient synthesis of quinoxaline catalyzed by papain and their evaluation for antibacterial activity.

Section B: Simple and efficient synthesis of nicotinamide catalyzed by papain and their evaluation for antibacterial activity.

In summary, we were able to establish papain as a novel biocatalyst for organic transformations. The papain as a biocatalyst promoted synthesis of variety of nitrogen containing heterocycles with ease of transformation. The papain as a biocatalyst was observed to be safe, economical and environmentally benign in carrying out complex organic MCRs. In addition all the synthesized compounds were evaluated for their antibacterial acivity and few of them showed promising antibacterial activity.

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